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V. N. KONDRAT'YEV'S WORK ON COMBUSTION KINETICS
AND CHEMICAL KINETICS IN GENERAL

Kondrat'yev is a prominent investigator in the fields of chemical kinetics, the structure of matter, molecular spectroscopy, photochemistry, and other subdivisions of physics and physical chemistry. His principal investigations deal with the theory of basic chemical processes and of the mechanism of complex chemical transformations. Kondrat'yev is one of the founders of the contemporary theory of the electronic structure of molecules. To this field belong primarily his investigations on the dissociation of nitrogen, bromine, and vapors of salts under the action of electrons and light quanta; his investigations on the determination of the heats of association of molecules; and his research on the mechanism of the processes of formation of molecules from free atoms and radicals. Kondrat'yev was the first to determine correctly the heat of the dissociation of oxygen molecules. One must note that as early as 1924 Kondrat'yev was the first to apply practically the method of mass spectroscopy for the determination of the products of the dissociation of salt vapors under the impact of electrons.

The early work of Kondrat'yev, carried out in the period 1924-1934, was marked by outstanding results in the application of contemporary physics to the solution of chemical problems. In his later work Kondrat'yev concentrated increasingly on chemistry. Investigation of the properties of free radicals and the study of their role in chemical kinetics became his principal field of interest.

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He initiated the application of the very effective method of line absorption spectroscopy for the identification and quantitative determination of free radicals. With the aid of this method, he investigated various properties of the free hydroxyl radical in many combustion reactions and established the important role that this radical plays in the reactions studied. Kondrat'yev also established that other radicals besides hydroxyl (e.g., SO and CS) are formed during many oxidation reactions. He investigated quantitatively the kinetics of the formation and of the disappearance of these radicals.

Further research led Kondrat'yev to the conclusion that atomic hydrogen in high concentrations is present within the rarefied hydrogen flame zone. To prove the correctness of this conclusion he developed a special method for determining the concentration of free atoms which are present during the course of chemical reactions. This method is based on the development of heat at a surface which catalyzes the recombination of atoms. The results obtained by the application of this method fully confirmed the theoretical assumptions which had been made on the subject under investigation.

On the whole Kondrat'yev's work furnishes the first example of kinetic research in which the thorough investigation of individual intermediate substances and of their reactions led to the formulation of the mechanism of a complex reaction in a manner susceptible to experimental proof and on the basis of data obtained experimentally. Kondrat'yev's work thus demonstrated how one should conduct the investigation of other complex reactions with the view of elucidating their mechanism.

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